

Dissociative ionization of water by O^+ collision in the perturbative regime

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Synopsis We report dissociative ionization of water by singly and multiply charged oxygen ions collision in the intermediate perturbative regime. Dissociation of multiply ionized H_2O^{n+} ($n \leq 5$) is investigated using a time-of-flight spectrometer in combination with a multicoincidence ion detection and an electrostatic cylindrical spectrometer. The time of flight ion-pairs distributions strongly reflect the degree of the ionization. From these data we infer the contribution of the ionization in the fragment-ion pair-production and compare it with the results extracted from the H^+ energy distributions. A comparison with He^+ , N^+ and C^+ projectiles colliding onto H_2O with similar interaction strengths is presented.

The multiple ionization with subsequent dissociation of the water molecules under impact of singly charged projectile ions (H^+ , He^+ , C^+ , N^+) have been investigated experimentally measuring time of flight ion-pairs spectra, electron and fragment-ions energy and angular distributions and theoretically in the framework of the CTMC, FB, CDW-EIS, IEVM, IPM and BGM models [1-3]. In the intermediate perturbative regime the reduced screening of the projectile nucleus by the electron cloud at small impact parameters is responsible for the multiple ionization induced by dressed charged projectiles. The calculations suggest that molecular dissociation depends on the interaction strength defined by the charge over velocity of the projectile (q/v), having influence on the degree of ionization of the molecule, in the kinetic energies of the ejected ions, and anisotropy in the fragment emission.

At the experimental side, at the Centro Atómico Bariloche we measured the energy distribution of the H^+ fragment employing an electrostatic analyser, while at the Federal University of Rio de Janeiro a coincidence time-of-flight technique was used to measure the multiple ionization channels. Figures 1a and 1b compare the H^+ energy distribution for several angles with the individual contribution of the dissociation channels (a) to (g) obtained from the CTMC calculations for 1 MeV O^+ impact ($q/v=1.1$). Figure 1c shows the relative abundance of channels (a) to (g) to the molecular multiple ionization followed by dissociation.

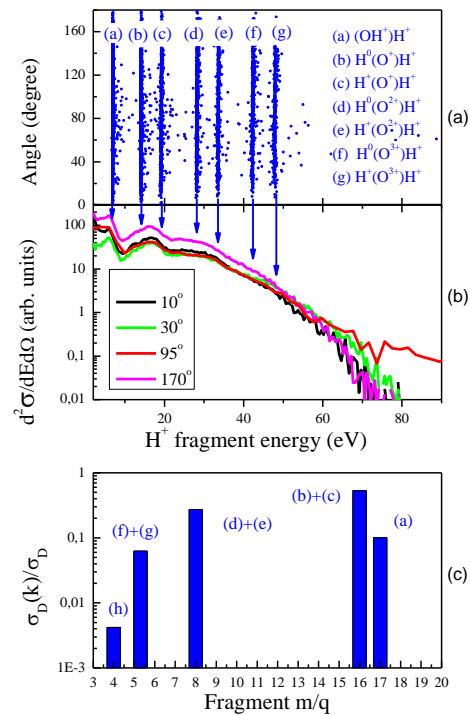


Figure 1. Dissociative ionization of water induced by 1 MeV O^+ . (a) CTMC angular distributions, (b) H^+ energy distributions and (c) Dissociative channels yields.

An overview of the experimental data for singly charged projectiles will be presented.

References

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